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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/642,607	08/19/2003	Brian A. Vaartstra	M4065.0133/P133-B	2821

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EXAMINER	
NOVACEK, CHRISTY L	
ART UNIT	PAPER NUMBER
2822	

DATE MAILED: 07/01/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/642,607	VAARTSTRA ET AL.	
	Examiner	Art Unit	
	Christy L. Novacek	2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 April 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *75-91* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *75-91* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

This office action is in response to the amendment filed April 11, 2005.

Response to Amendment

The amendment of claim 89 is sufficient to overcome the objection to claim 89 stated in the previous office action. Therefore, this objection is withdrawn.

The amendment of claim 81 is sufficient to overcome the rejection of claim 81 under 35 U.S.C. 112, second paragraph stated in the previous office action. Therefore, this rejection is withdrawn.

Applicant has provided evidence in this file showing that the invention was owned by, or subject to an obligation of assignment to, the same entity as Sandhu et al. (US 6,313,035) at the time this invention was made, or was subject to a joint research agreement at the time this invention was made. Therefore, the rejection of claim 86 as being unpatentable over Ovshinsky et al., in view of Lu, Mosely et al. and Sandhu et al. (US 6,313,035) is hereby withdrawn. Claim 86 is now rejected under Ovshinsky et al., in view of Lu, Mosely et al. and Sandhu et al. (US 5,246,881). Sandhu (US 5,246,881) qualifies as prior art under 35 U.S.C. 102(b) and, therefore, is available as prior art under 35 U.S.C. 103(a) regardless of its assignment.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 75-85 and 88-91 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ovshinsky et al. (US 6,087,674, previously cited) in view of Lu (US 6,017,818) and Mosely et al. (US 5,877,087).

Regarding claims 75 and 88, Ovshinsky discloses depositing a single layer (6,8) containing a first metal (titanium), aluminum, nitrogen and boron on a semiconductor substrate (10) (col. 9, ln. 44 – col. 10, ln. 5 of 6,087,674 patent and column 10, ln 33-61 of the parent 5,825,046 patent). Ovshinsky does not disclose what method is used to deposit this layer. Like Ovshinsky, Lu discloses depositing a single layer containing titanium, boron and nitrogen as part of a semiconductor device manufacturing process (Abstract). Lu teaches that this layer is deposited using a particular chemical vapor deposition (CVD) process because it offers the advantages of being able to deposit a layer having good conformability and low defect density (col. 2, ln. 29-48). Lu's CVD method involves placing the wafer into a CVD chamber, heating the wafer and introducing a metal (titanium) precursor, a nitrogen precursor and a boron precursor into the chamber to simultaneously deposit the Ti-B-N layer (col. 3, ln. 30-55). Lu does not disclose incorporating aluminum into the layer. Like the Ti-B-N layer of Lu, Mosely discloses that an aluminum-containing layer can also be conformally deposited by a CVD process using an aluminum precursor (col. 5, ln. 8-22). At the time of the invention, it would have been obvious to one of ordinary skill in the art to deposit the Ti-Al-N-B layer of Ovshinsky using a CVD process as disclosed by Lu and Mosely because these reference teach that CVD will result in a layer that is conformal and of a low defect density.

Regarding claim 76, Lu discloses that a single gas serves as the titanium precursor and the nitrogen precursor (Abstract).

Regarding claims 77, 79 and 91, Lu discloses that the titanium and nitrogen precursor can be $Ti(N(CH_3)_2)_4$ (tetrakis-dimethyl-amido-titanium) (TDMAT) (Abstract).

Regarding claim 78, Lu discloses heating the wafer to a temperature of 300-500°C (col. 3, ln. 47-50).

Regarding claims 80 and 90, Mosely discloses that the aluminum precursor is dimethylaluminumhydride (DMAH) (col. 5, ln. 8-22).

Regarding claim 81, Lu discloses that the titanium precursor can be tetrakisdiethylamidotitanium (TDEAT) (col. 6, ln. 51-58).

Regarding claim 82, Lu discloses that the metal (titanium) precursor is an organometallic compound.

Regarding claim 83, Lu discloses that the boron precursor is a boron reactant gas (col. 6, ln. 51-58).

Regarding claims 84 and 85, Lu discloses that a nitrogen precursor is a nitrogen reactant gas.

Regarding claim 89, for the reasons discussed above in reference to claim 75, it would have been obvious to one of ordinary skill in the art to deposit the Ti-Al-N-B layer of Ovshinsky using a CVD process as disclosed by Lu and Mosely. Lu and Mosely disclose that the CVD process may be conducted by heating the wafer within the range of 250-500 degrees Celsius (col. 3, ln. 49-51 of Lu and col. 5, ln. 13-14 of Mosely). Lu and Mosely disclose that the pressure within the reactor may be 0.1-80 torr (col. 3, ln. 51 of Lu and col. 5, ln. 16-18 of Mosely).

Claim 86 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ovshinsky et al. (US 6,087,674) in view of Lu (US 6,017,818) and Mosely et al. (US 5,877,087) as applied to claim 75 above, and further in view of Sandhu et al. (US 5,246,881).

Regarding claim 86, Ovshinsky, Lu and Mosely do not disclose the structure of the CVD apparatus used to deposit the Ti-Al-B-N layer. Sandhu discloses using a CVD process to deposit a titanium-containing layer from a TDMAT precursor. Sandhu states that in order to form a titanium-containing layer having good film uniformity, a carrier gas is used to vaporize and

transport the TDMAT precursor in a bubbler (col. 3, ln. 4-41; col. 6, ln. 13-15). At the time of the invention, it would have been obvious to one of ordinary skill in the art to use a bubbler to provide the titanium precursor because Russell discloses using a TDMAT precursor to CVD deposit the titanium-containing layer and Sandhu states that by providing a carrier gas with the TDMAT in a bubbler, a titanium-containing film having good uniformity can be formed.

Claim 87 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ovshinsky et al. (US 6,087,674) in view of Lu (US 6,017,818) and Mosely et al. (US 5,877,087) as applied to claim 75 above, and further in view of Ward et al. ("New Developments in CVD Source Delivery and Source Reagents").

Regarding claim 87, Ovshinsky, Lu and Mosely do not disclose the structure of the CVD apparatus used to deposit the Ti-Al-B-N layer. Ward discloses it is beneficial to use a using liquid source delivery CVD process to deposit a titanium-containing layer from a TMDAT precursor because vapor source delivery CVD methods suffer the problems of being difficult to control and maintain. Ward teaches that direct liquid injection of precursors in a chemical vapor deposition process eliminates those problems. At the time of the invention, it would have been obvious to one of ordinary skill in the art to use a direct liquid injection system to provide the precursors because Lu and Mosely disclose using CVD to deposit the Ti-Al-N-B layer and Ward teaches that by providing the precursors to the CVD chamber by way of a direct liquid injection system, the problems associated with a vapor source delivery system can be avoided.

Response to Arguments

Applicant's arguments filed April 11, 2005 have been fully considered but they are not persuasive.

Regarding the rejection of claims 75, 88 and 89 as being unpatentable over Ovshinsky in view of Lu and Mosely, Applicant argues that Ovshinsky fails to disclose any particular deposition method of his Ti/Al/N/B layers 6 and 8A. Its is precisely for this reason, that one of ordinary skill in the art would have to rely on another reference or his own personal knowledge to determine how to deposit the Ti/Al/N/B layers of Ovshinsky. As evidenced by the Lu, Mosely and Sandhu patents, at the time of the invention, it was well-known in the art that Ti-N and Al-containing layers could be successfully deposited for use in a semiconductor device using a CVD method and result in a Ti-N and Al-containing layer having good film characteristics. It would have been obvious to one of ordinary skill in the art to use CVD to deposit the Ti/Al/N/B film of Ovshinsky, because, in the absence of the disclosure of any particular process, one of ordinary skill would look to use a conventional process (such as that disclosed by Lu, Mosely and Sandhu) to make the Ti/Al/N/B layer.

Further regarding the rejection of claims 75, 88 and 89 as being unpatentable over Ovshinsky in view of Lu and Mosely, Applicant argues that Ovshinsky does not disclose that the Ti/Al/N/B layer is to have the good film characteristics discussed by Lu and Mosely. However, one of ordinary skill in the art would recognize the inherent advantage in depositing all films of a semiconductor device such that they are good quality films, as substandard quality films would render the device inoperable and, therefore, useless. As stated in section § 2144 of the MPEP, "The strongest rationale for combining references is a recognition, expressly or impliedly in the prior art or drawn from a convincing line of reasoning based on established scientific principles or legal precedent, that some advantage or expected beneficial result would have been produced by their combination. *In re Sernaker*, 702 F.2d 989, 994-95, 217 USPQ 1, 5-6 (Fed. Cir. 1983)."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christy L. Novacek whose telephone number is (571) 272-1839. The examiner can normally be reached on Monday-Thursday and alternate Fridays 7:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

CLN
June 23, 2005

AMIR ZARABIAN
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